**Windbag Wonders**

Master Bernoulli's principle and expand the bag with a single breath using air pressure.

Here's the challenge... How many breaths would it take to blow up a 2 meter (8 ft) long bag? Depending on the size of the person, it may take anywhere from 10 to 50 breaths of air. However, with a little practice and some scientific knowledge of air... you will be able to inflate the bag using only one breath!

Materials: Windbag

## Experiment

1. Unroll one of the Windbags and tie off one end with a simple overhand knot.
2. Put the bag over your mouth, take your time, and blow three big breaths of air into it. Grab the bag in front of your mouth and squeeze your hand to close it off. Slide that hand forward down the bag pushing the air you blew into it toward the knotted end. How did you do? The bag is completely full. Right? Oh, not so much?
3. Looking at the disappointingly inflated Windbag, estimate the number of breaths it would take to fill the bag. You can get a fairly decent measurement by holding up the “inflated” Windbag to an unrolled Windbag. How many breaths would it take for you? We’re going to show you how to do it in one.
4. Have your assistant hold the knotted end of the Windbag at your mouth level. The bag should be horizontal and straight away from you. Spread out your fingers and hold the opening of the bag as wide open as you can get it.
5. Keep your mouth about six inches from the wide-open end of the Windbag. Take a couple of deep breaths (don't over do it or you risk fainting) and blow a single, comfortable breath of air into the bag (without touching it with your mouth).
6. Quickly grab and seal the bag with your hand as you did before. Slide your hand forward until it stops. It's likely you'll be surprised! Now you can either tie off the end with a simple knot like you did before or push the air out from the other end and have your assistant give it a try. Compare this inflation with the first one and share a high five with your assistant. You both deserve it!

## How Does It Work?

The bag quickly inflates because air from the atmosphere is drawn into the bag from the sides next to the stream of air from your lungs. For you science types out there, here's the technical explanation. In 1738, a scientist named Daniel Bernoulli observed that a stream of fast moving air is surrounded by an area of low atmospheric pressure. In fact, the faster the stream of air moves, the lower the air pressure drops around it. When you blow into the bag, you create an area of low pressure inside the bag and higher pressure air around you in the atmosphere rushes into the bag to equalize things. In other words, air in the atmosphere is drawn into the bag at the same time you are blowing into it.